CLAIMS

What is claimed is:

1. A self-encoding analytic chemical sensor array comprising:

a) a substrate with a surface comprising discrete sites; and

b) a population of microspheres comprising at least a first and a second subpopulation, wherein each subpopulation comprises at least one reporter dye;

wherein each subpopulation emits a first characteristic optical response signature when subjected to excitation light energy in the presence of a reference analyte;

wherein said microspheres are distributed on said surface.

2. A sensor array according to claim 1 wherein each subpopulation further comprises a bioactive agent.

3. A sensor array according to claim 1 and 2 wherein the reporter dye comprises a fluorescent dye.

4. A sensor array according to claim 1 and 2 wherein the reporter dye comprises a solvatochromic dye.

5. A sensor array according to claim 4 wherein the solvatochromic dye comprises Nile Red.

6. A sensor array according to claim 1, 2, 3, 4 and 5 wherein the beads are encoded with a predetermined ratio of at least two reporter dyes.

7. A sensor array according to claim 2 wherein said bioactive agent is selected from the group consisting of nucleic acids and proteins.

8. A sensor array according to claims 1, 2, 3, 4, 5, 6 and 7 wherein said substrate is a fiber optic bundle and said surface is a proximal end of said bundle.

9. A sensor array according to claims 1, 2, 3, 4, 5, 6, 7 and 8 further comprising an excitation light energy source in optical communication with said proximal end.

10. A sensor array according to claims 1, 2, 3, 4, 5, 6, 7, 8 and 9 further comprising an emission light energy detection means in optical communication with said proximal end.

11. A method of detecting a target analyte in a sample comprising:

a) contacting said sample with an sensor array comprising:

i) a substrate with a surface comprising discrete sites; and

ii) a population of microspheres comprising at least a first and a second subpopulation, each subpopulation comprising:

1) a bioactive agent; and

2) at least one reporter dye;

wherein said reporting dye has a first characteristic optical response signature when subjected to excitation light energy in the presence of a reference analyte;

wherein said microspheres are distributed on said surface;

b) detecting the presence of said analyte.

12. A method according to claim 11 further comprising identifying the location of each bioactive agent on said substrate by adding said reference analyte.

13. A method according to claim 11 and 12 wherein said detecting is done by detecting the presence of a label attached to said target analyte.

14. A method of decoding an array composition comprising

a) providing an array composition comprising:

i) a substrate with a surface comprising discrete sites; and

ii) a population of microspheres comprising at least a first and a second subpopulation, wherein each subpopulation comprises at least one reporter dye;

wherein said reporting dye has a first characteristic optical response signature when subjected to excitation light energy in the presence of a reference analyte;

wherein said microspheres are distributed on said surface; and

b) adding at least one reference analyte to said array composition to identify the location of at least one subpopulation.

15. A method according to claim 14 wherein the location of each subpopulation is determined.

16. A method for reducing the signal-to-noise ratio in the characteristic optical response signature of a sensor array having subpopulations of sensor elements comprising:

a) measuring the optical response signature of at least two of said sensor elements of at least one of said subpopulations; and

b) summing the optical response signatures.

17. A method according to claim 16 wherein prior to said summing, the baseline of at least one optical response signature is adjusted.

18. A method according to claim 16 wherein the signal-to-noise ratio is increased by a factor of at least 10.

19. The method of claim 16 wherein an analyte detection limit is reduced by a factor of at least 100.

20. The method of claim 16 wherein said sensor array comprises a population of beads dispersed on a substrate.

21. The method of claim 20 wherein said substrate is a fiber optic bundle.

22. The method of claim 20 further comprising identifying the location of each sensor element within each sensor subpopulation within the array.

23. The method according to claim 16 wherein said sensor elements comprise chemical functional groups.

24. The method according to claim 16 wherein said sensor elements comprise oligonucleotides.

25. A method for amplifying the characteristic optical response signature of a sensor array having subpopulations of sensor elements comprising:

a) measuring the optical response signature of at least two of said sensor elements of at least one of said subpopulations; and

b) summing the optical response signatures.

26. A method according to claim 25 wherein prior to said summing, the baseline of at least one optical response signature is adjusted.